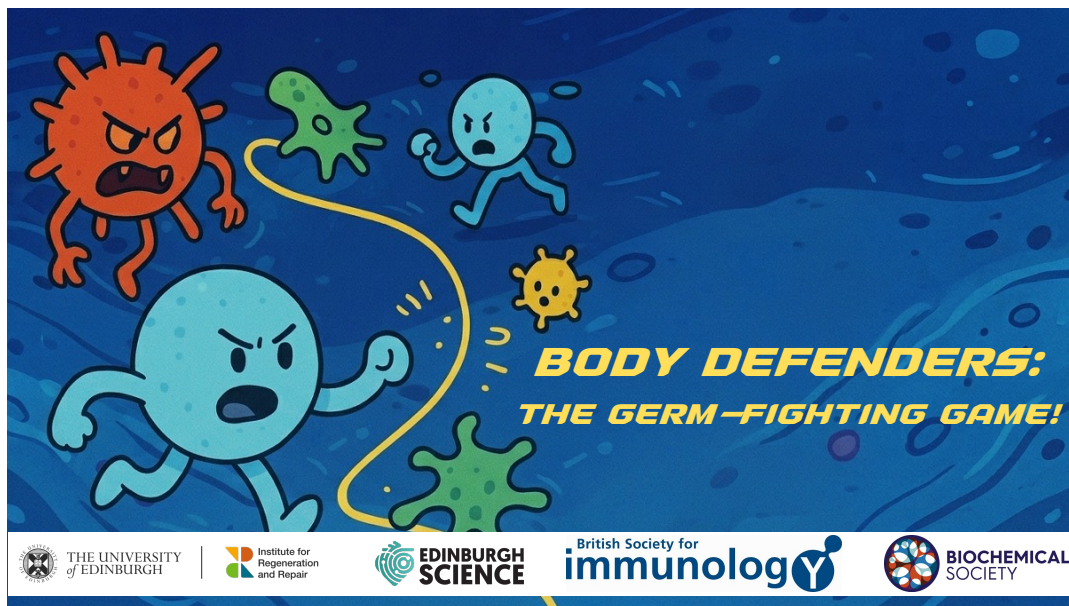


Body Defenders: The Germ-Fighting Game!

Workshop description (for the organizers):

“*Body Defenders*” is a hands-on workshop where children discover how physical forces like pushing, pulling, sticking, and squeezing help protect our bodies from infection. Through a series of short, playful experiments, participants will follow the journey of the body’s defenders — immune cells — as they sail through the bloodstream, navigate into tissues, and finally devour invading germs.



Edinburgh Science Festival brochure (for the public):

Body Defenders: The Germ-Fighting Game!

Put on your lab coat and join us to explore the hidden forces that keep us healthy! In this hands-on workshop, we will experiment with how immune cells stick, squeeze, and slurp their way to defeat infections. Through exciting experiments, real microscope videos and creative challenges, you’ll uncover the amazing mechanics behind your body’s defences — and take science into your own hands!

Event format: 60-minute workshop

Venue: National Museum of Scotland (NMS) Studio 1

Age range: 7+

Date(s): Wed 8th April, 3 iterations starting at 11am, 2pm and 3.30pm

Production and access requirements: 16 spaces available for children. All children must be accompanied by an adult. Adult admission to be included in child’s ticket.

Workshop Structure

Timeline:

- Introduction (1-8 minute)
- Four activity stations (9-45 minute; 4 x 9 minutes):
 1. Rolling and Sticking
 2. Cells on the Move
 3. Eating the Enemy
 4. Microscope Corner
- Final Quiz (46-53 minute)
- Wrap-up (54-60 minute)

Each activity will include:

- Short introduction (~1 minute)
- Experiment + discussion (~6-7 minutes)
- Microscope movie (~1 minute)
- Passport stamping (kids will receive a passport to stamp at the end of each activity)

You can find a description of each activity below, including:

- Materials
- Suggested Openers (two or three sentences to say at the start)
- Prompts (example questions to ask while kids are playing)
- Key takeaways (one sentence to wrap up)
- Microscope video links
- Sample Q&A and keywords

Appendices:

- Final Quiz: "Which Immune Cell Are You?"
- Stamp designs
- Sticker designs

Introduction

Opener:

- Who here has ever had a cold, a sore throat, or a tummy bug?
- I see a lot of hands! Well, I have some good news: that actually means your body has an amazing defense team working for you right now.

Key idea:

- Today, we aren't just learning about science!
- **We're stepping into the shoes of your immune cells.**
- These are tiny body defenders that float in your blood, squeeze through tight gaps, and crawl through your body to hunt down and eat germs.
- Today, you will be the defenders!

Passport handout:

- To track your journey, everyone is getting one of these: your **Immune Mission Passport**.
- Your goal today is to complete four activities and get a stamp for each of them.
- Once your passport is complete, you'll take a special quiz to discover your **Unique Immune Cell Identity**. Are you a fast responder? A specialist strategist? Or an expert observer? You'll find out at the end!

Expectation-setting:

- Lab Coats On – First, put on your lab coats.
- Get Hands-On: You'll be touching things and moving around.
- Make Hypotheses: You'll be guessing what might happen next. You can use your passport to draw or write down your observations.
- New Discoveries: In this lab, there are no wrong answers - only new discoveries.
- The Grown-Up Rule: Grown-ups can help with the experiments, but they aren't 'answer machines.' The big discoveries come from you.

Transition line:

Are you ready? You're about to travel through the body - rushing through blood, squishy tissues, and active battle zones so grab your passports and let's go!

Rolling and Sticking

Using transparent tubes, we will test how immune cells can travel through the bloodstream and stick to blood vessel walls at the site of infection. Participants will use plush germ magnets to try and catch white and red blood cells.



Then, we will simulate what happens next when immune cells escape the bloodstream and release the extracellular traps to kill the germs. Children will add vinegar (dyed with food colouring described as 'germs') to a tube containing baking soda powder (described as 'white blood cells') and observe the explosive reaction that follows.

Materials:

Part 1:

- Magnetic white beads (~4 mm diameter)
- Non-magnetic red beads (~4 mm diameter)
- Plastic tubing (~8 mm diameter)
- Magnets (with accompanying plush germs)

Part 2:

- Vinegar
- Food colouring
- Baking soda
- Plastic tubes, spoons, and pipettes
- Paper towels for clean-up

Openers:

- Imagine you are an immune cell floating quickly through the bloodstream. Suddenly, there's an infection nearby. How do you stop and get off the bloodstream highway?

Prompts:

- Which beads slow down and stick?
- Which beads keep moving?
- What happens next once the immune cell escapes the bloodstream?

Key takeaways:

- Immune cells can slow down and roll along blood vessels before stopping.
- They use special 'sticky' molecules to grab onto vessel walls.
- This helps immune cells leave the bloodstream exactly where they are needed.

Microscope video moment:

- Let's watch real immune cells rolling along a blood vessel.
- Show a short clip of leukocyte rolling, for example:

<https://www.youtube.com/shorts/QA9BMf2dekA>

<https://www.youtube.com/shorts/NFyTuGWP0pY>

<https://www.youtube.com/shorts/9o-FlC4yad4>

- These white blood cells are slowing down and rolling along the vessel wall before stopping — just like our beads.

Transition line:

- Great work defenders! It's time to get a new stamp into your Immune Mission Passport. You can now travel to the next part of the body.



Cells on the Move

Using labyrinth trays lined with different materials, children will explore how immune cells crawl across tissues with different physical properties.



Materials:

- Plastic trays
- Custom-built labyrinths (e.g., made of wood, Perspex, or sponge)
- Tray fillers: sponge, slime, and sand
- Marbles
- Wipes

Openers:

- Once immune cells leave the blood, they have to move through different body parts. That's not always easy.
- Imagine walking through mud, grass, or sand. Would you move the same way?
- Your body isn't the same everywhere — some parts are soft, some are stiff. Let's see how that feels for a cell.

Prompts:

- Which surface is hardest?
- What helps the cell move?
- Would speed or strength matter more here?
- Which surface slows the cell down most?
- Does the cell slide, sink, or bounce?
- Do you think cells push, pull, or both?

Key takeaways:

- Cells move differently depending on the tissue.
- Moving through the body takes effort and strategy.
- Cells don't just float — they feel their environment and adapt.
- Immune cells sense their surroundings and change how they move.

Microscope video moment:

Scientists actually study how fast cells move in different tissues — here's what it looks like for real:

<https://www.youtube.com/watch?v=uKid8QmBI0I>

<https://www.youtube.com/watch?v=V61n8a6dpOo>

https://www.youtube.com/watch?v=l_xh-bkiv_c

<https://www.youtube.com/shorts/AHOIeO9sXH8>

Eating the Enemy

Children will model how immune cells stretch and change shape to engulf germs using playdough and marbles.



Materials:

- Playdough
- Marbles

Opener:

- This cell doesn't have teeth. So how does it eat?

Prompts:

- Can it stretch?
- Does it grab one germ or many?
- What happens after the germ is inside?
- What happens if the germ is bigger?
- What do you think happens inside the cell?

Key takeaways:

- Immune cells change shape to eat and destroy germs.
- Immune cells surround germs and break them down.

Microscope video moment:

- This is a real immune cell eating bacteria/This is happening in your body all the time:

<https://www.youtube.com/watch?v=iZYLeIJwe4w>

<https://www.youtube.com/watch?v=LXno0vcW2Go>

Sample Q&A and keywords:

- Q: Do cells chew germs?
A: No — they wrap around them and take them inside.
- Q: Are germs alive inside the cell?
A: No — the cell breaks them down safely.
- Keyword: Engulf
"To engulf means to completely surround something."

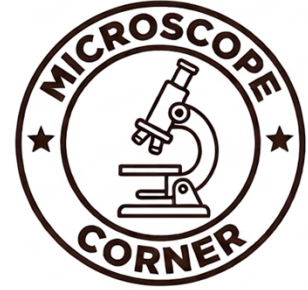
Note:

If time allows, origami antibody and virus making could be incorporated into this activity. Instructions created for the British Society for Immunology by scientist-turned-artist Dr Lizzie Burns are available here:

<https://www.immunology.org/public-information/activities-and-resources/origami-antibody-and-virus>

Microscope Corner

Children will visit the Microscope Corner to observe prepared slides or printed images of cells.



Materials (options):

- Printed images with labels
- Laptop looping short clips
- Microscope and pre-made slides

Openers:

- Everything you've tried today is happening inside your body — let's look at the real thing.
- Scientists use microscopes to see things too small for our eyes.
- These are real blood cells caught on camera.

Prompts:

- What shapes do you notice?
- Which cell looks the most active?
- Why do you think scientists use microscopes?
- What surprises you?
- Does this look like you expected?

Key takeaways:

- Microscopes let us see how cells really behave.
- Scientists watch cells to understand how the body works.

Sample Q&A and keywords:

- Q: Are the colours real?
A: Sometimes — scientists add colours to help us see details.
- Q: Why do cells move so slowly on screen?
A: Many videos are sped up or slowed down so we can see them.
- Keyword: Microscope
“A microscope is a tool that lets us see very tiny things.”

FINAL QUIZ: “WHICH IMMUNE CELL ARE YOU?”

Children can complete the quiz with their parents.

How to play:

Pick the answer that feels *most* like you.

There are no wrong answers!

Q1. Something surprising happens. You:

- | | |
|-------------------------------|--------------------------|
| A) Act right away | C) Check what’s going on |
| B) Stay calm and deal with it | D) Think before you act |

Q2. You start a new challenge. What matters most to you?

- | | |
|------------------|--------------------------|
| A) Being fast | C) Watching and learning |
| B) Not giving up | D) Doing it just right |

Q3. You’re in a group and things suddenly change. You:

- | | |
|-----------------------|----------------------|
| A) Adapt quickly | C) Help others |
| B) Keep things steady | D) Focus on your job |

Q4. When you explore a new place, you:

- | | |
|----------------------------------|----------------------------|
| A) Move fast and react as you go | C) Look around carefully |
| B) Take your time | D) Remember the paths well |

Q5. When learning something new, you prefer to:

- | | |
|----------------------|---------------------------------|
| A) Try it right away | C) Ask questions and observe |
| B) Practice a lot | D) Get really good at one thing |

Q6. Which sentence sounds *most* like you?

- | | |
|---------------------|------------------------------------|
| A) “Let’s go!” | C) “Let’s see what’s happening.” |
| B) “I’ve got this.” | D) “I’ll remember this next time.” |

★ RESULT REVEAL ★

Count your letters! Which one did you pick the most?

A) NEUTROPHIL — *Fast Responder*

You act fast and jump into action!

Neutrophils are the first ones to respond when something happens.

B) MACROPHAGE — *Steady Defender*

You are steady and keep going, even when it gets hard.

Macrophages keep things under control over time.

C) DENDRITIC CELL — *Expert Observer*

You're great at noticing what's going on.

Dendritic cells spot important clues and help others decide what to do.

D) LYMPHOCYTE — *Specialist Strategist*

You think carefully and remember the details.

Lymphocytes target specific threats and remember them for future.

💡 BIG IDEA 💡

Your body needs all of these *Body Defenders* working together!



Stamp designs



Sticker designs

